A New Organisational Ecology for Open Innovation: The Innovation Value Institute

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Abstract: In this paper a new theoretical framework for Innovation Eco-Systems is proposed and the application of the model in the Innovation Value Institute (IVI) is described. The IVI is engaged in the development of the IT-Capability Maturity Model which is a response to the need for a more systematic, comprehensive approach to managing IT in a manner that meets the requirements of practicing IT professionals.

Keywords: Innovation, Open Innovation, Ecological Systems, IT, IT Innovation.

1 Introduction

Innovation is now a major focus for organizations, regions and economies and the topic is increasingly seen as being crucial not only to success but to survival. The topic of innovation is both complex and wide-ranging and is now a key component of the strategic management of organisations. Addressing this situation presents a number of challenges such as: agreeing a definition of the concept and making sense of the voluminous literature from eclectic sources. Many questions increasingly exercise the minds of managers, entrepreneurs, policy makers and academics as they grapple with this perennially important topic. These include reasons why an innovation is successful in one organization and met with resistance in another and how it is that certain innovations diffuse easily through an environment while others do not. After almost half a century of intense research and theorizing, the academic contribution to answering questions such as these is less than convincing (Fagerberg, 2005).

Addressing this challenge, the Innovation Value Institute (IVI, 2011) provides an example of practitioner-academic engagement that has a global reach. The Institute was co-founded in 2006 by the National University of Ireland Maynooth, (NUIM) and Intel to help drive the transformation of IT management. The IVI Consortium draws from a peer community of over seventy Academic Institutions, Partner Organizations and End-Users (from both the Public and Private Sectors). Furthermore IVI is a response to the enduring call for the academic community to ground its research (Ågerfalk, 2010, Goldkuhl, 2012) and adopt practice orientated approaches (Costello et al., 2011, Mårtensson and Lee, 2004). The aim of the IVI is to facilitate a collaborative community of like-minded peers committed to investigating, advancing and disseminating the frameworks, tools and best practices associated with managing IT Value and IT enabled Innovation. IVI is currently focused on the development and distribution of the IT Capability Maturity Framework (IT-CMF) which maps IT organizations onto a capability maturity curve based on empirically derived industry best practice across 33 different capabilities within IT management

2. Background

This section will initially provide a brief overview of the concept of innovation as it pertains to this study. We will examine the innovation literature and argue that the subject is ripe for a new theoretical formulation to progress research in the area

2.1 Innovation Studies

Many scholars trace the introduction of innovation into the realm of economic and social change to Joseph Schumpeter's seminal work on the "Theory of Economic Development" (Schumpeter, 1934). In this work he classified innovation into five categories: new products (or goods), new methods of production (or processes), new sources of supply (or half-manufactured goods), the exploitation of new markets, and new ways to organize business. In Schumpeter's original schema, innovation is accomplished by "entrepreneurs" who developed new combinations of existing resources (Swedberg, 1991). However, in his later works, he came to regard the large corporation as the innovative engine driving the development of leading economies (Lazonick, 2005). Fagerberg (2005) makes the fundamental distinction between invention and innovation where the former is regarded as the "first occurrence" while the latter is the "first attempt to carry it out into practice". This is in line with Van de Ven's (1986) assertion that "an invention or creative idea does not become an innovation until it is implemented or institutionalized". Storey (2004) points out that debate on the very meaning of the term innovation has been controversial and problematical. One of the main challenges of a review of innovation is the range of definitions from a wide body of literature. In their analysis of the terms *innovation* and *innovativeness* from 21 empirical studies in the new product development (NPD) literature, Garcia *et al.* (2002) discovered that "no less than fifteen constructs and at least 51 distinct scale items" were used leading to a great deal of ambiguity (p.110). The Minnesota Innovation Research Program (MIRP) resulted in important pioneering work on innovation and its publications are generally known as the Minnesota studies (Van de Ven et al., 2000). The MIRP program was carried out by approximately 40 researchers, now scattered among faculty across the globe, who conducted longitudinal studies of 14 innovations during the 1980s. Four basic factors are implicit in their work: new ideas, people, transactions and institutional context. The

increasingly important role of academia in supporting innovation in knowledge-based societies has led to the development of a number of models from national systems of innovation (NIS) (Lundvall, 1995) to the more recent Triple-Helix model of university-industry-government relations (Etzkowitz and Leydesdorf, 2000). The fragmentation of organizational boundaries by, on the one hand the move towards open and user-lead innovation (Chesbrough, 2003, von Hippel, 2005) and on the other hand, the development of social networking and networks of practice (Whelan, 2007) is currently the subject of growing academic interest.

The main point from this brief overview is to provide a basis for our argument that the study of innovation is a complex, multi-dimensional phenomenon with dynamic interactive characteristics that invites a novel theoretical framework.

Now we will proceed to outline the theoretical framework.

2.2 Theoretical Framework

Urie Bronfenbrenner spent most of his professional career as Professor of Human Development, Family Studies and Psychology at Cornell University. His development of Ecological Systems Theory (Bronfenbrenner, 1979) is regarded as having revolutionized studies in these areas by shattering barriers and building bridges among the social science disciplines. Previous to Bronfenbrenner's work, the study of human development was compartmentalized among psychology, sociology, anthropology, economics and political science. However, through the concept of the ecology of human development, these disparate environments were integrated into a holistic conceptual framework of interdependent nested systems where human development was viewed as a continuum (Lang, 2005). Bronfenbrenner viewed a "child's development within the context of the system of relationships that form his or her environment" with each complex "layer" influencing the development (Paquette and Ryan, 2001). His own conception of the theory was as "a set of nested structures, each inside the next, like a set of Russian dolls"(Bronfenbrenner, 1979). He acknowledges the debt he owes to the theories of Kurt Lewin who expressed behavior as a function "of the interplay between person and environment" in the form of a classic equation shown below. Furthermore, Bronfenbrenner affirms that his theoretical framework originated from Lewin's antecedent work that places behavior in context: "-situational, interpersonal, sociological, cultural, historical- and above all theoretical" (2005,p. 43.)

$$B = f(PE)$$

Lewin's well-known formula expresses *behavior (B)* as a combined *function (f)* of forces from within a *person (P)* and from the external *environment (E)* (Jackson, 1998).

Bronfenbrenner argued that Lewin's formulation did not include a time dimension and proposed his own version of the equation for the area of human development. Here development is regarded as a function of the person interacting with the environment which includes the effects of both constancy and change (the time dimension) on personal characteristics throughout the life span (2005 p 108) which is captured in the following equation.

$$D = f(PE)$$

Bronfenbrenner affirmed that a major motivation for his work was to provide both psychological and sociological depth to Lewin's theories. He claimed his theory differed from antecedent research models in that he analyzed the environment in *systems* terms. His theory is shown diagrammatically in Figure 1.

Cranefield and Yoong (2007) in a recent debate proposed that ecological systems theory can enrich our understanding of practice by providing a more holistic view of the area . They built their thesis mainly on McLeroy *et al.*'s (1988) work on an ecological perspective for health promotion programs which had transposed the original work of Urie Bronfenbrenner to that discipline. Acknowledging our debt to the suggestion of Cranefield and Yoong, we now go to the sources of Bronfenbrenner's main work (1979, 2005) and propose a modified framework for the area of innovation.

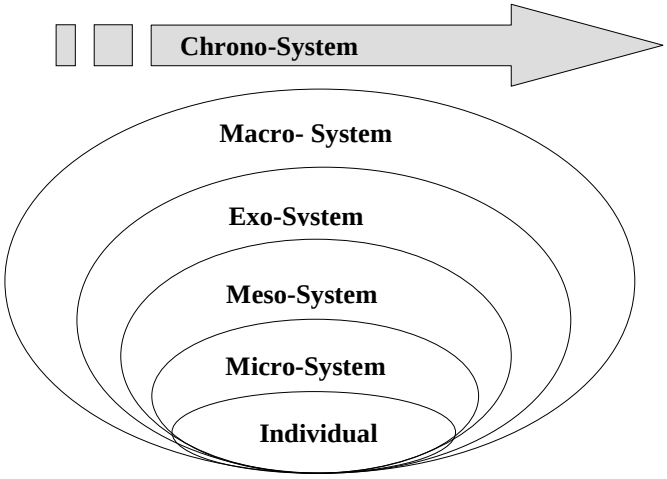

Figure 1: Ecological Systems Framework –adapted from Cranefield &Yoong (2007)

We will initially describe each nested layer of the modified Bronfenbrenner model where the "patterned behavior" is determined by the following:

- Individual level: Intrapersonal factors-characteristics such as knowledge, attitudes, behavior, self-concept, skills etc. It also included the developmental history of the person.
- Microsystem: interpersonal processes and primary groups –formal and informal social network and social support systems, including the family, work group and friendship networks.
- Mesosystem: institutional factors –social institutions with organizational characteristics, with formal (and informal) rules and regulations for operation.
- Exosystem: community factors-relationships among organizations, institutions, and informal networks within defined boundaries.
- Macrosystem: public policy – local, state and national laws and policies.

- Chronosystem: This was a later addition by Bronfenbrenner and was not taken into account by McLeroy et al. This concept "encompasses change or consistency over time not only in the characteristics of the person but also of the environment in which that person lives" (Marentette, 2007).

Now a revised innovation framework is described based on the theoretical framework presented above and shown in figure 2

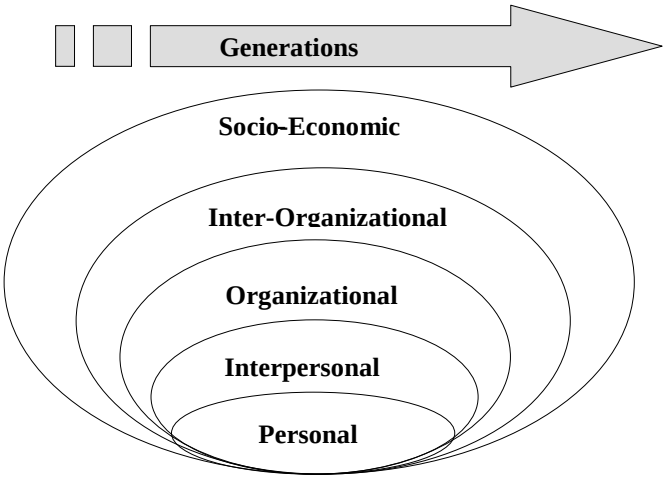

Figure 2: An organizational ecology for innovation research.

Personal Dimension: this layer includes the intrapersonal characteristics that assist or inhibit innovativeness. Development of knowledge, skills and competencies through education and training to support innovation both in terms of creative invention and of implementation are relevant here (Amabile et al., 2003).

Interpersonal: formally this dimension will include the ability to contribute to and direct teams or work groups. Informally it will include social networks, communities of practice and personal contacts, both inside and outside the organization. Interpersonal attributes such as empathy will also be deemed relevant in this layer (Ciborra, 2002).

Organizational: the characteristics of the organization that the person is a member of will be significant for this layer. Culture, climate, and the management of innovation and change will influence the person's tendency to innovate (Goffin and Mitchell, 2005).

Inter-organizational Systems: this layer will include relationship of the organization with peer organizations, academic institutions, state-sponsored support bodies (Etzkowitz and Leydesdorf, 2000). The layer will also encompass formal and informal networks, clusters that support innovation, and the general area of inter-organizational systems (IOS) which is having increasing influence on business to business (B2B) and business to government relationships.

Socio-economic: this dimension will include innovation policy of local, regional, state and supra-national (for example the European Union), National Systems of Innovation (NSI) (Lundvall, 1995), indicators of innovation (OECD, 2005) and important economic theories of innovation (Schumpeter, 1934).

Chronological Generations: Analogous to human development, "generations" can encompass a number of concepts. At a macro level it will take cognizance of the time dimension of the innovation environment which has been, for example, outlined in Rothwell's (1994) taxonomy of innovation processes. At the organizational level this would involve assessing the innovation maturity level such as the "archetypes" of innovation proposed by Tidd et al. (2005). In the realm of information systems Ward et al. (1990) developed a three era model of IS to illustrate this concept.

3. Ecological Constructs

There is almost universal agreement that innovation is a complex phenomenon to understand and manage (Allen, 2004, Eppinger, 2001, Goffin and Mitchell, 2005, Katz, 2004, OECD, 2005, Poole and Van de Ven, 2000, Rothwell, 1994) while Storey (2004) points out that debate on the very meaning of the term has been controversial and problematical. This section will provide a tabulation of innovation constructs from a number of prominent researchers based on the taxonomy in figure 2 above.

3.1 Personal Dimension

Herzberg's (1968) seminal work on motivation found that people are "motivated by interesting work, challenge, and increasing responsibility" (p. 87). Good management and working conditions will help to ensure that they do not become dissatisfied but this will not meet their deep-seated need for growth and achievement.

Table 1 Enabling conditions for innovation at the personal level

Amabile et al., 2003	**Parnes *et al.* (1977)**	**Nemeth (2004)**
Creativity	Creativity equation, C = K x I x E*	Ability to "look outside the box"
Meaningful Urgency	Problem solving	Questioning attitude

* knowledge, imagination and evaluation

3.2 Interpersonal Dimension

Teams have been described as the fundamental learning units in the modern organisation (Pedler et al., 1991) and are being used effectively in areas related to innovation such as product development, process centred organisations and project management (Ulrich and Eppinger, 2000, Cooper, 2001, Pugh, 1991, Otto and Wood, 2001).

Table 2 Enabling conditions for innovation at the interpersonal level

(Pedler et al., 1991)	Allen (2004)	Leonard (1998)
Learning units	Technological gatekeepers	Empathy
Teamwork	Mediators	Understanding

3.3 Organizational Dimension

Innovation is the process of introducing a new method, idea or product. Some prominent researchers in the knowledge management field have been concerned with the identification of the conditions necessary for the encouragement and nurturing of innovation in organizations. Nonaka, Leonard-Barton and Garvin have all identified critical enabling conditions needed for innovation to thrive in organizations. There are striking similarities between the conditions proposed by these three leading thinkers. Table 2 lists the conditions proposed by each writer and clusters the conditions around five themes.

Table 3 Enabling conditions for innovation in organizations (Choo 1999)

(Nonaka 1991)	(Garvin 1996)	(Leonard-Barton 1995)
Organization intention	Purposeful learning	Strategic Intent
Autonomy	Culture of self-assessment	Signature Skills
Creative Chaos	Critical thinking	Creative Abrasion
Information Redundancy	Time to learn	Information-porous boundary
Requisite variety	Experimentation	Cognitive diversity

3.4 Inter-Organizational Systems

According to Kumar and van Dissel "interorganizational systems exist to support and implement cooperation and strategic alliances between two or more organizations" (Kumar and van Dissel, 1996) p 281. Furthermore for quite some time the dramatic growth of inter-organizational systems (IOS) have altered the way organisations conduct business and relate to each other (Premkumar and Ramamurthy, 1995).

Table 4 Enabling conditions for innovation at the inter-organizational level

(Etzkowitz and Leydesdorf, 2000).	Mitra and Formica (1997)	Manimala (1997)
Triple-Helix	Networking	Disseminating knowledge
Industry collaboration	Interconnectedness,	Creation of entrepreneurial environment by education sector
Academic collaboration	Interdependency	Technology Transfer

3.5 Socio-Economic Dimension

Chesbrough (2003) argues that in many industries the centralised approach to R&D which he terms "closed innovation" has become obsolete. This paradigm, he contents, must be replaced by "open innovation" which adopts external ideas and knowledge in conjunction with the internal process.

Table 5 Enabling conditions for innovation at the socio-economic level

Chesbrough (2003)	von Hippel (2005)	Christensen (2005)
Mobility of skilled people	Democratization of innovation	Performance overshoot
"Not all the smart people work for us"	User-centric innovation processes	Moore's law
New business models		Convenience and customization

3.6 Chronological Generations

Table 6 Enabling conditions for innovation at the socio-economic level

Rothwell's (1994)	Tidd et al. (2005)	Ward et al. (1990)
Five-generation model	Maturity level	Three era model

4. The Innovation Value Institute

The development of the IT-CMF (Curley, 2004, Curley, 2006, Curley, 2007) is a response to the need for a more systematic, comprehensive approach to managing IT in a manner that meets the requirements of practicing IT professionals. In this paper an overview of the rationale for the IT-CMF will be provided and, in particular, some of the guiding principles for it design and development will be presented.

This research is being undertaken by the Innovation Value Institute (www.ivi.ie). Applying the principles of Open Innovation 2.0 (Samelin. B. and Curley, 2011) IT Management is being investigated using a design process with defined review stages and development activities based on the Design Science Research guidelines advocated by Hevner et al. (2004).

A key goal of the development of the IT-CMF was to enable a structural change in the way companies and organizations get value from IT. A key assumption in developing the IT-CMF was that a three hundred and sixty degree view of the issue and knowledge/practices used in contemporary IT management practice was necessary. Accordingly a global research community was established and nurtured to provide comprehensive views, knowledge and practices. Thus a new research ecosystem was established involving members from six different communities; Technology Providers, Public Sector IT executives, Enterprise IT executives, Analysts, IT Professionalism organizations and Academics. This form of research ecosystem activity is a form of Open Innovation 2.0 (Samelin. B. and Curley, 2011) where all the actors in an ecosystem are involved in the research and innovation activity. This is an extension of the open

innovation activity defined by Chesbrough (2003) which refers to capitalizing on the inflows and outflows of ideas to and from a company.

4.1 The IVI's Eco-System

Figure 3 describes IVI's application of Ecological Systems Theory in its development of the IT-CMF. Each layer is then described.

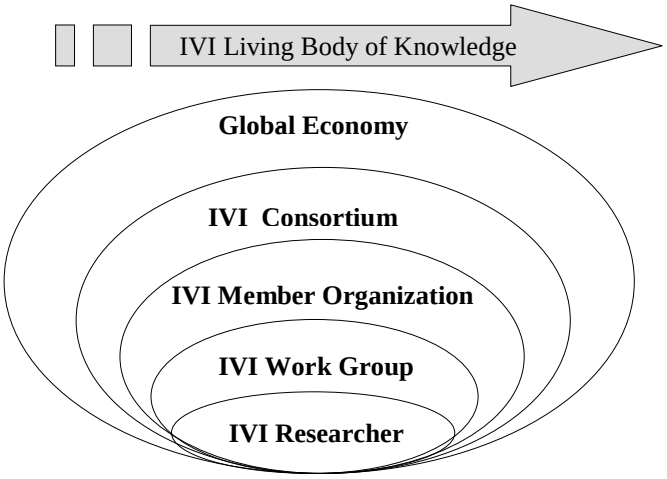

Figure 3: IVI's ecology for IT innovation research.

IVI Researcher: Researchers work on collaborative projects with industrial partners from various sectors, such as telecommunication, financial service, healthcare and government. This intensive interaction and collaboration with organizations can be characterized as an "action research" approach with design science principles. Researchers are co-located and are placed at both at the University and at the corporate partner. They are expected to spend significant time at the corporate side.

IVI Workgroup: IVI personnel have regular meetings between researchers, students and corporate partners defining research objectives, performance measures and discussing the research results. Research is conducted by Working Groups that consist of consortium members, leading academics and IT organizations. Output from the Working groups is reviewed with the Consortium Technical Committee and findings are tested and validated with other companies.

IVI Member Organization: Membership is for organizations that are active in information technology (IT) management, business value realization from IT and supporting IT innovation practices. Since its foundation, IVI has grown in strength and now has over 75 members drawn from top global organizations including BP, Chevron, Cisco, Fujitsu, SAP, Chevron, Ernst & Young to name a few.

IVI Consortium: The IVI Consortium draws from a peer community of:

- Academic Institutions
- Partner Organizations
- End-Users (Public and Private Sector)

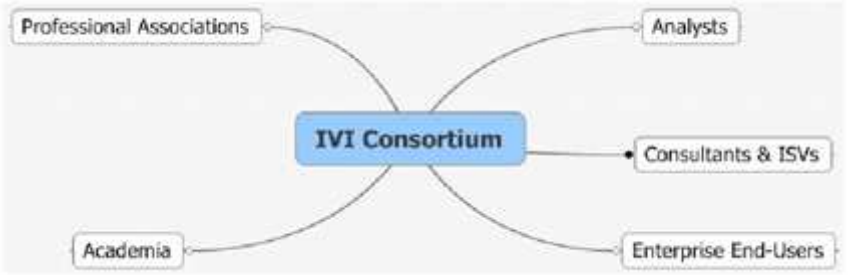

Figure 4: IVI consortium map

Global Economy: The goal of IVI is to create a global gold standard for IT management in order to benefit organizations world-wide. The aim is to have a positive effect on the global economy where IT is becoming increasingly influential in business and public sector transactions.

IVI Living Body of Knowledge: The IT-CMF comprises four macro-capabilities to emphasize their complexity and their importance in managing IT for business value. IT-CMF breaks down each macro-capability into critical capabilities of which there are 33 presently. These critical capabilities are a specific set of key activities and procedures that must be defined and mastered to enable the IT organization to plan and deliver IT solutions. They are continuously being reviewed by the work-groups and can be considered as a living body of knowledge available to the consortium.

5. Conclusions

This paper has presented an example of how the Innovation Value Institute has mobilized an entire ecosystem using an open innovation approach resulting in the development of a new set of artifacts and design patterns that are being adopted by a broad set of IT executives and organizations globally. The increasing adoption of the artifacts is perhaps the strongest validation of the utility and effectiveness of the approach.

This paper addressed the need for a novel theoretical framework to stimulate research in the area of strategic innovation. The work is a response to the assessment by scholars that there are significant research questions to be addressed in this important topic. For example Dubin (1978) argues that theory serves to satisfy a basic human need; to provide order to the experienced world while Weick (1989) proposes that theory building involves activities such as abstracting, generalizing, relating and synthesizing.

Arising from the analysis, we proposed a new theoretical lens to stimulate research in the area. The result is an adaptation of Urie Bronfenbrenner's ecological systems theory (EST) that applies it to the innovation landscape. The EST for IT innovation is an important theoretical contribution because it provides a fresh perspective for academic researchers to investigate the phenomenon; and it offers an accessible conceptual structure to navigate the increasingly complex innovation ecosystem.
In summary, many organizations today are struggling to accurately capture or manage the true value from their IT investments. Furthermore, organizations are demanding that their IT Capability better support or drive innovation within the organization. The Innovation Value Institute is responding to this challenge by merging practice oriented research concepts with in-depth field studies of organisational transformation.

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